U.S. RESEARCHERS DEVELOP FLOOD-TOLERANT RICE

WASHINGTON, AUGUST 28 -- Rice grown anywhere in the world soon could be made completely flood-tolerant because of new research by geneticists at the University of California-Riverside (UCR) in collaboration with scientists at the University of California-Davis and the International Rice Research Institute in the Philippines.

The work was funded by grants from the U.S. Department of Agriculture and the U.S. Agency for International Development.

By gradually introducing "submergence tolerance" into California rice -- a property that enables rice to survive extreme flood conditions -- the researchers show how any rice variety worldwide potentially could be made to survive short-term floods that completely submerge the rice plant.

The researchers are the first to identify a small cluster of related genes responsible for giving a line of Indian rice the capacity to survive complete submergence for more than two weeks.

Cropland flooding is a frequent natural disaster in many regions of the world, reducing crop productivity.

Rice, the primary food for more than 3 billion people, thrives in standing water but dies if it is completely submerged for more than four days. Water covering the rice plant reduces the plant's oxygen and carbon dioxide supplies, affecting photosynthesis and respiration.

The researchers transferred the cluster of genes into California rice by cross-pollinating the Indian and California rice and then continuing the crossbreeding over several generations until all the Indian rice genes, except the cluster of genes needed for submergence tolerance, gradually were replaced with genes from the California rice.

The result was California rice that can withstand floods that completely cover the rice plant.

In the work, led by UCR genetics professor Julia Bailey-Serres, the researchers evaluated two nearly genetically identical lines of California rice: the original submergence-intolerant line and the new submergence-tolerant line.

Comparing the two California rice lines showed that in the submergence-tolerant line, the rice plants orchestrate several cellular responses to submergence that are controlled by specific genes present in the submergence gene cluster.

This cluster, which originated in the Indian rice and was bred into the California rice, is responsible for changes in cell metabolism and growth while the plant is submerged.

"One of the genes in the submergence gene cluster makes rice conserve the carbohydrate reserves in the plant leaves when the plant is submerged, resulting in a controlled growth for the plant," said Bailey-Serres.

"Rice plants that lack this particular gene, however," she said, "are not able to conserve their carbohydrates. They end up with accelerated growth and ultimately exhaust themselves."

Bailey-Serres said that access today to information about the rice genome – all the genetic material in the chromosomes of rice – has accelerated progress in identifying specific genes that confer specific traits.

In the future, Bailey-Serres and colleagues plan to work on developing crops that are resistant to multiple stresses.

"For example," she said, "we'd like to develop rice that is both submergence and salt tolerant," she said, "given that many flood-prone areas are a mixture of fresh and salt water."

Text of the press release (http://www.newsroom.ucr.edu/cgi-bin/display.cgi?id=1395) is available at the University of California-Riverside Web site.

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